consisting as it did in many places of the large-type statements of the treatise, without the small-type mathematical demonstrations—was too strong meat for the babes of the Glasgow class. The muttered groans of the students, when on Friday Thomson would first ask them to read twenty or thirty pages of the book before Monday, and then turn to McFarlane and tell him to see that questions were set on the part prescribed in the forthcoming Monday morning examination paper, never reached his ear, and with a bland smile, as if he had just prescribed a novel for the week-end, he used to turn to his oral examination and his lecture.

With regard to the somewhat strong remarks, which we find quoted on p. 445, as to the absurdity of causing Thomson to teach elementary physics, it is right to say that in 1846, when he sought and obtained the chair, the plain everyday duty of the professor of natural philosophy was to teach the natural philosophy class, and that, so far as Thomson was concerned, his time, energy, and original power were far from wasted in meeting from day to day his band of students, most of them eager to learn, and many of them willing to help in his researches. There is no doubt whatever that the attempt to teach them gave him inspiration, and from them came, as another important reward, his laboratory corps, who helped him so much. Witness the tribute to the divinity and other students in the Bangor address. Moreover, it does not seem to be generally known that from the early 'seventies onwards Thomson met the ordinary class only twice, and the higher class only once, a week. He would most certainly have been himself the strongest objector to any arrangement that would have cut him off altogether from his ordinary students. The reflection on the University is undeserved.

Prof. Thompson's second volume begins with 1871, in which year Thomson was president of the British Association at its meeting in Edinburgh. During the following fifteen years or so he was at the height of his activity. His Atlantic cable-laying expeditions were over in 1869, and he had purchased the *Lalla Rookh,* and begun the series of yachting excursions and hydromechanical and other experiments at sea which resulted in the compass and sounding machine. A year or two later some further cable-work was undertaken, which occasioned an eventful visit to Madeira; and then came the introduction into navigation of the fully corrected compass and the sounder, which are now in one form or another on board every well-found and properly equipped sea-going vessel. In the 'eighties he delivered the Baltimore lectures, and invented the various standard electrical instruments for exact laboratory and workship measurements. Afterwards, in the 'nineties, came the peerage, the presidency of the Royal Society, and the never-to-be-forgotten jubilee celebration in 1896.

Of Lord Kelvin's cable work, both theoretical and practical, extending from 1857 to 1874, and of his many other practical activities, Prof. Thompson's book contains an admirable account. It is written in such a way that anyone, however non-mathematical or non-physical, can read it with interest and enjoyment. No such person can lay down the second volume without a feeling of amazement that so much achievement in high regions of scientific discovery and invention could be crowded into one life, even though that extended far beyond the Psalmist's three score years and ten. Indeed, the book may do much good by telling the public at large how much it is indebted for its safety in travelling, for telegraphic communication from continent to continent and between the old world and the new, and for many other benefits (to say nothing of the advancement of natural knowledge), to patient investigation carried on by one man and his corps of willing students and assistants.

There are a few corrections here and there that we should like to see made in a new edition, but these are not of any great consequence, and need not be here enumerated. We have come to the end of the space allotted to this review, and only a few points here and there have been touched upon. The thronging memories of the past suggest innumerable topics on which we might dwell. All around are memorials of the great man who has passed away and the work he carried through. But it is better to forbear, and in a last word to commend Prof. Thompson's book to all who care to know something of the life and the victories of a leader of the armies of peace.

A. GRAY.

DYNAMIC ELECTRICITY.

Electricity. By H. M. Hobart. Pp. xix+207. (London: Constable and Co., Ltd., 1909.) Price 6*s.* net.

IN this book the author attempts to impart to the reader a fundamental knowledge of dynamic electricity without using mathematics, or rather without giving mathematical proofs of his statements. He evidently believes in the possibility of such study, for in the preface he says that

> "Without any accompanying study of other text-books, almost anyone who is in earnest can make good progress in acquiring a fundamental knowledge of the subject of electricity, by a careful study of the present treatise."

Now this is rather an ambitious statement, but if the author had followed the orthodox method of using mathematics in elucidation of experiment he might have succeeded. He has, however, deliberately discarded the use of the most efficient tool we have in the interpretation of experimental results, and thus the task of the reader is made more difficult, and not more easy, as he hoped to make it. The author cannot do entirely without mathematics, or at least without expressing certain relations by mathematical formulæ, but he gives these without showing how they are obtained, merely as statements without proof. Here are a few examples: on p. 59 we are told that a circular conductor 1 cm. long, and carrying 10 amperes, acts on a unit pole in the centre of the circle with a force of 1 dyne. No proof is given for this statement, yet, starting from this, the author develops, also without mathematical proof, the law that the magnetic field round an infinite straight con-

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ductor varies inversely as the distance from the conductor. On p. 83, merely as a footnote, we get a simplified version of Minchin's formula for the total flux through a coil of circular cross-section, and on p. 85 Perry's formula for the flux through a coil of rectangular cross-section. On p. 87 we find the well-known formula for the induction in the centre of a long solenoid, but in none of these cases is a proof given.

This tendency to do without mathematical reasoning is surely futile; a reader who does not know even the small amount of mathematics which suffices for the elementary study of electricity had better leave the subject alone; and the reader who has the required mathematical knowledge is not helped by finding the most simple relations set forth in long tables and perfectly obvious diagrams. Yet the book is interesting to the man who knows the subject. He will find many things, which are treated in all text-books in the orthodox way, presented in a different manner, and although the treatment is sometimes rather verbose, it is at any rate original. As regards nomenclature, the originality is perhaps carried a little too far. That the term "kelvin" is used to denote the unit ordinarily called the kilowatt-hour might be passed over as permissible, since some other authors have adopted the same term, though it is by no means generally accepted; but there is no justification for introducing the term "siemens" for the watt-hour. This unit is hardly ever used, and to coin a special term for it is quite unnecessary. The terms "continuous electricity" and "alternating electricity" are also unusual, whilst the abbreviation "ats" for ampere-turns is not very happily chosen.

The first six chapters, dealing with the specific resistance of conductors, the conception of current, voltage, energy, power, and explaining Ohm's law, are very elementary. The definition of the unit of energy, taken as the kilowatt-hour, is unusual. According to the author's nomenclature, the "kelvin" is that amount of energy which will raise the temperature of a ton of water by 0·86° C. This is surely a roundabout way for a book on electricity, especially as the conception of the mechanical equivalent of heat is not used to connect the "kelvin" with the "joule," but the relation between the two units is simply stated in a table.

The following chapters deal with the magnetic field, the E.M.F. generated in moving conductors, alternating currents, inductance, the magnetic circuit, and insulating materials. The passage dealing with the relation between time and current in a circuit to which an E.M.F. is suddenly applied is an object-lesson of the futility of attempting to treat such a subject without mathematical basis. It cannot be done; and thus we find Helmholtz's formula suddenly introduced without any proof, and then worked out at great length algebraically for a special case. Then we get to the time constant and more numerical calculations, with the usual complement of tables and curves. The best chapter in the whole book is that on insulating materials. Here we get on to the solid ground of experimental evidence. Tables and curves are given for the disruptive strength of a great variety of insulating materials, the influence of temperature is discussed, as are also the methods of testing for disruptive strength and the thickness of slot insulation found necessary from practical experience. The specialist who has to design high-pressure machinery will find this part of the book very useful.

GISBERT KAPP.

AN ARTIST-ORNITHOLOGIST IN EGYPT.

Egyptian Birds, for the Most Part seen in the Nile Valley. By Charles Whymper. Pp. x+221; with 51 coloured plates. (London: A. and C. Black, 1909.) Price 20*s*.

WE have nothing but praise for Mr. Whymper's drawings. Being more in the nature of landscapes with birds in the foreground than figures of birds with a suitable background, they naturally gain from an artistic standpoint, and this has not detracted from their value as guides towards identification. Many of the drawings are, indeed, most pleasing pictures, and convey a delightful impression of the surroundings amongst which the visitor to Egypt may expect to see the birds depicted. On the whole, Mr. Whymper has not suffered greatly at the hands of the block-maker, though we may remark generally that the colouring of the plates is more pleasing by artificial light than by daylight, and we imagine that the green legs and feet of the griffon vulture, the purple hues of the chats, and such like inaccuracies in colouring are due to the engraver's or printer's art rather than to the artist's.

Whether the author has been wise in his choice of "types" of Egyptian birds—only some fifty or sixty species in all are figured and described—is perhaps a matter for argument, but in a book which aims at teaching the traveller in Egypt "something of the birds he sees," it seems a waste of opportunity to devote plates and descriptions, amongst so few, to such birds as the kingfisher, house-sparrow, heron, snipe, and lapwing, which every Englishman who takes the smallest interest in birds must know; while the inclusion of the shoebill, which has never occurred in Egypt, because it is a favourite at the Giza Zoological Gardens, is really absurd—one might as well include the giraffe in an account of the mammals of England! The use of the book as an aid to identification is thus very small, for it will help the average Englishman to identify barely forty birds which he does not already know, and the volume is a large one for so small a gain in knowledge.

Turning now to the letterpress, the author disarms minute criticism by his statement that the book is not intended for the ornithologist, but he implies that its purpose is, in some measure at all events, educative, so that we may fairly point out some inaccuracies, for we cannot commend the author's ornithology in the same spirit as we can his art. As an example, we may direct attention to the description of the crested lark, in which not a word is said of there being a number of well-marked geographical races of this bird peculiar to different localities in Egypt—obviously a very interesting point which, had it been explained,

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